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Tolerance of rising dietary concentrations of esterified propoxylated glycerol (EPG) among human volunteers

David H. Bechtel*

Best Foods, Division of CPC International, 150 Pierce St., Somerset, NJ 08873, USA

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ABSTRACT

A solid form of esterified propoxylated glycerol (EPG) was administered to 16 healthy male volunteers in butter-like spread and baked goods, resulting in intakes that rose in 30-g increments from 30 to 150 g; each level was administered on a single day, followed by a 2-day washout period. Elevated serum transaminase (ALT and/or AST) and lower HDL cholesterol levels were noted at 60 g and greater, possibly related to changes in the diet (high-carbohydrate and increasingly low-fat), rather than to EPG itself. There was no apparent association between EPG consumption and adverse effects reported. In general, EPG had no effect on bowel function, except in a single subject, who reported increased frequency of movements during the 2 days that followed consumption of 150 g EPG. All abnormal values returned to normal after the study, and subjects were otherwise asymptomatic. Accordingly, the effects on transaminase and HDL levels observed in this study were considered possibly adaptive and not clinically significant. Experimental animal studies, including lifetime studies, had shown no effects on these parameters. More importantly, the effect was associated with intakes of 60–150 g EPG, which exceeds the approximate intake of 20 g/day or less expected from currently intended commercial food uses.

1. Introduction

Esterified propoxylated glycerols (EPGs) are modified triglycerides, sterically blocked to prevent hydrolysis by pancreatic lipase. This results in a compound that is protected from digestion and therefore minimally absorbed.

A series of articles examining the non-clinical and clinical safety of esterified propoxylated glycerols (EPGs) was recently published (Bechtel, 2014a, 2014b; Christian and Bechtel, 2014; Davidson and Bechtel, 2014; Tyl and Bechtel, 2014a, 2014b; Wedig and Bechtel, 2014). Part of the series included an 8-week study in which human volunteers received a solid form of EPG at levels up to 40 g per day in a butter-like spread and in baked goods (Davidson and Bechtel, 2014). The current article presents the findings of a separate study in which human volunteers received EPG in a similar way, but at concentrations that increased over time from 30 to 150 g.

2. Materials and methods

2.1. Study design

The study was sponsored by ARCO Chemical Company (Newtown Square, PA, USA) and Best Foods (Somerset, NJ, USA), and conducted at Inveresk Clinical Research (Edinburgh, Scotland) in 1992 as a single-center, domiciled, single-blind study. Prior to enrollment, each subject underwent screening, including medical history, physical exam with routine blood and urine analyses, and electrocardiogram (ECG); informed consent was obtained. Inclusion/exclusion criteria were: healthy males; age 18–50 years; ±20% of ideal body weight; no prescription medication; no history of gastrointestinal disease/disorder; no clinically significant abnormal laboratory result; no substance addiction (≤20 cigarettes/day).

Sixteen healthy male volunteers completed the study. Subjects were domiciled for a period of 21 days, including 3 pre-study adaptation days, and 3 days during which foods items containing only ordinary triglycerides were administered. Subjects received defined amounts of EPG incorporated into food products over the course of a given day in a rising-concentration scheme, with a 2-day washout period in between, as illustrated in Table 1.

* Intertek Scientific & Regulatory Consultancy, 100 Davidson Avenue, Suite 102, Somerset, NJ 08873, USA.
E-mail address: david.bechtel@intertek.com.

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Table 1
Total EPG (g) administered to subjects each day during the study.

Study day																					
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
0	0	0	0	0	0	0	30	0	0	60	0	0	90	0	0	120	0	0	150	0	0

2.2. Test material

The form of EPG tested was a solid form, H-EPG-05 HR/SO 9:1, incorporated into bakery items and a butter-like spread. The test materials were provided by the sponsors as components of dietary items appropriate for breakfast, lunch, dinner, and snacks. The test food items (containing ordinary triglycerides and/or EPG) were cinnamon buns, biscuits, cookies, and butter-like spread. All test food items were unit-packaged by study subject number, and labeled such that study subjects remained blinded.

As Table 2 illustrates, EPG replaced more of the dietary fat as the study progressed. This was accomplished by progressively replacing test food items containing only ordinary triglycerides with test food items containing EPG.

2.3. Measures

Vital signs (blood pressure, pulse, respiration, body temperature) were measured daily. Gastrointestinal symptoms, bowel movement patterns, and adverse events were assessed daily. Serum chemistry, hematology, and urinalysis (pH, specific gravity, ketones, protein, glucose, bilirubin, blood, leukocytes, WBC count, red blood cell count, and microscopic examination of sediment) were performed the day after EPG consumption.

2.4. Statistical analysis

Due to the small sample size, descriptive statistics were used to summarize adverse events, general GI symptoms, and bowel movement patterns. The number of subjects reporting events (incidence rate) daily and the total number of reported events were summarized. Laboratory evaluations were summarized by day to assess mean changes from baseline.

3. Results

3.1. EPG consumption

The calculated EPG intake for the nominal concentrations of 30, 60, 90, 120, and 150 g were 31.1, 61.2, 91.6, 119.7, and 149 g, respectively.

3.2. Physical exam, vital signs, ECG

There was a mean increase in body weight of 1.7 kg (range: −0.6–3.9 kg) over the course of the study. All vital sign measures were within normal limits and no abnormal trends were noted. All ECG findings were within the normal limits, except for one subject, who displayed a prolonged QRS interval (0.126 s) at the end of the study (Day 22). The principal investigator did not consider this finding to be clinically significant or related to the test substance.

Table 2
Total EPG and fat consumption.

Study day						
	4	7	10	13	16	19
Nominal EPG (g)	0	30	60	90	120	150
Actual EPG (g)	0	31.1	61.2	91.6	119.7	149.0
Total fat (g)[a]	301.6	269.7	239.4	208.4	182.9	148.9

[a] Includes fat from test foods and other food items.

3.3. Hematology

Mean hematology values, all of which were within the normal range, are summarized in Table 3. On an individual-subject basis (data not shown), all Hb, MCH, MCV, and basophil values were within the normal range. Values for the remaining hematological parameters were occasionally slightly above or below the normal range. Slightly greater LUC (large unclassified cell) levels (0.21–0.31 $\times$ 10^9/L *vs.* normal range of 0–0.2 $\times$ 10^9/L) were observed once in each of 8 subjects (4 after 90 g; 1 each after 120 g and 150 g; and 2 on the second day after 150 g).

3.4. Clinical chemistry

Mean clinical chemistry values, summarized in Table 4, were within the normal range for all parameters, except ALT, bicarbonate, and HDL cholesterol. However, there was evidence of high bicarbonate levels before consumption of EPG (*i.e.*, at screening and with 0 g EPG).

Mean ALT levels were greater than normal (*i.e.*, >40 IU/L) after consumption of 60–150 g EPG; at 30 g ALT levels were greater than prior to EPG consumption, but remained within the normal range.

Mean HDL cholesterol levels were normal at screening, but below normal at all other time points, including after consumption of test food items containing only ordinary triglycerides (0 g EPG).

On an individual-subject basis (data not shown), all values were within the normal range for BUN, Na, Cl, globulin, A/G ratio, Ca, and total bilirubin. With the possible exception of AST, ALT, and HDL cholesterol, all abnormal values were considered unrelated to EPG. The highest ALT and AST level after EPG consumption was 3 times greater than normal; the lowest HDL level was approximately 30% below the lowest end of the normal range.

3.5. Urinalysis

Mean urine specific gravity and pH values are listed in Table 5. Traces of protein, glucose, or bilirubin in the urine were seen occasionally, but the findings were not considered by the principal investigator to be clinically significant; in some instances, repeat analysis showed negative results. One subject (# 8) had traces of red blood cells in the urine at various times, but the principal investigator did not consider this to be related to the study material.

Table 3
Mean hematology values among subjects receiving increasing EPG concentrations in the diet.

Time period	EPG concentration	Hb (g/dL)	RBC ($\times 10^{12}$/L)	Hct (L/L)	MCH (fl)	MCV (pg)	MCHC (g/dL)	WBC ($\times 10^9$/L)	Neut ($\times 10^9$/L)	Lymph ($\times 10^9$/L)	Mono ($\times 10^9$/L)	Eos ($\times 10^9$/L)	Baso ($\times 10^9$/L)	LUC ($\times 10^9$/L)	Plat ($\times 10^9$/L)
Pre-study	None	15.0 ± 0.4	5.15 ± 0.21	0.446 ± 0.018	29.1 ± 0.9	86.7 ± 2.6	33.5 ± 0.8	7.81 ± 2.11	4.83 ± 1.89	2.10 ± 0.51	0.46 ± 0.13	0.23 ± 0.27	0.05 ± 0.02	0.14 ± 0.02	231 ± 44
Day 5	0 g[a]	14.6 ± 0.6	4.95 ± 0.27	0.441 ± 0.020	29.6 ± 0.8	89.3 ± 2.2	33.2 ± 0.6	7.43 ± 1.40	4.16 ± 1.12	2.25 ± 0.65	0.51 ± 0.12	0.29 ± 0.32	0.05 ± 0.02	0.16 ± 0.06	230 ± 47
Day 8	30 g	14.5 ± 0.7	4.86 ± 0.27	0.426 ± 0.021	29.9 ± 0.7	87.7 ± 2.0	34.1 ± 0.6	7.72 ± 1.65	4.33 ± 1.40	2.33 ± 0.64	0.53 ± 0.14	0.32 ± 0.34	0.05 ± 0.02	0.16 ± 0.04	223 ± 38
Day 11	60 g	14.6 ± 0.7	5.06 ± 0.28	0.441 ± 0.024	28.9 ± 0.9	87.1 ± 2.1	33.2 ± 0.7	7.63 ± 1.63	4.36 ± 1.19	2.22 ± 0.47	0.52 ± 0.15	0.31 ± 0.36	0.05 ± 0.02	0.16 ± 0.04	224 ± 40
Day 14	90 g	14.8 ± 0.5	4.99 ± 0.23	0.429 ± 0.018	29.6 ± 0.8	86.0 ± 1.9	34.4 ± 0.7	8.00 ± 2.03	4.65 ± 1.71	2.22 ± 0.75	0.55 ± 0.13	0.34 ± 0.38	0.05 ± 0.02	0.19 ± 0.06	221 ± 44
Day 17	120 g	14.3 ± 0.6	4.91 ± 0.25	0.427 ± 0.021	29.3 ± 0.8	87.1 ± 2.1	33.6 ± 0.6	7.65 ± 1.45	4.50 ± 1.32	2.11 ± 0.49	0.53 ± 0.13	0.30 ± 0.34	0.05 ± 0.02	0.15 ± 0.04	226 ± 48
Day 20	150 g	14.7 ± 0.6	5.08 ± 0.24	0.434 ± 0.020	28.9 ± 0.7	85.5 ± 1.8	33.8 ± 0.6	7.94 ± 1.41	4.59 ± 1.19	2.25 ± 0.56	0.55 ± 0.11	0.33 ± 0.36	0.05 ± 0.02	0.17 ± 0.05	230 ± 54
Day 22	None	14.8 ± 0.6	5.04 ± 0.25	0.436 ± 0.018	29.4 ± 0.8	86.5 ± 2.2	34.0 ± 0.8	8.64 ± 2.12	5.28 ± 2.02	2.29 ± 0.64	0.57 ± 0.11	0.28 ± 0.28	0.05 ± 0.02	0.18 ± 0.04	251 ± 53
	Normal range	15.5 ± 2.5	5.5 ± 1.0	0.47 ± 0.07	29.5 ± 2.5	86 ± 10	32.5 ± 2.5	7.5 ± 3.5	2.0–7.5	1.5–4.0	0.2–0.8	0.04–0.4	0.01–0.1	0–0.2	150–400

Values represent the mean ± SD for 16 subjects.
Hb: hemoglobin; RBC: total red blood cell count; Hct: hematocrit; MCV: mean cell volume; MCH: mean cell hemoglobin; MCHC: mean cell hemoglobin concentration; WBC: white blood cell count; Neut: neutrophil; Lymph: lymphocyte; Mono: monocyte; Eos: eosinophil; Baso: basophil; LUC: large unclassified cells; Plat: platelet count.
[a] Test food items prepared with ordinary triglycerides (margarine) alone.

3.6. Adverse events

The majority of adverse events reported was related to gastrointestinal symptoms and occurred on the days the test foods were consumed (Table 6). None appeared to be related to EPG consumption *per se*, although reports of flatulence (number of times reported and number of subjects) occurred more frequently with EPG *vs*. ordinary triglycerides (0 g EPG).

No serious adverse events were reported. The only unusual symptoms reported were anal pain in Subject # 1 and blood in the stool of Subject # 4. In Subject # 1, the effect was considered related to irritation due to frequent bowel movements following consumption of 150 g EPG (see Bowel Function section). Subject # 4, who reported passage of blood in the stool following consumption of 150 g EPG, was found to have a small anal tear.

3.7. Bowel function

As Table 7 illustrates, bowel movements (total bowel movements) were most frequent on days the test foods were administered. In general, EPG intake was associated with a shift toward a greater number of movements rated as "formed but soft" *vs*. "formed but hard," but there was no consistent association with EPG concentration.

Aside from being asked questions about the number of bowel movements, appearance, and discomfort (*e.g.*, pain, straining and cramping), subjects were asked if there was anything unusual about the stool appearance and, if so, to provide a description. As Table 7 shows, there was no apparent relationship between EPG concentration and the number of bowel movements rated by subjects as "unusual," with the possible exception of Subject # 1, who reported a total of 10 "unusual" movements during the 2 days that followed consumption of 150 g EPG; the movements were described as "loose" with "white particles" or "oil on surface of water." All other "unusual" movements that occurred following administration of EPG were seen only with 30 g and/or 60 g, but not thereafter, or with 30, 90, and 150 g, but not 60 or 120 g "Unusual" movements were also seen following administration of margarine alone (0 g EPG).

4. Discussion

Dietary concentrations of EPG ranging from 30 to 150 g had no apparent effect on vital signs. Body weights increased slightly during the study, possibly due to greater consumption of carbohydrates from the test foods. Some variations in hematology, clinical chemistry, and urinalysis parameters were observed. However, most deviations from normal were not considered clinically significant or related to EPG, by virtue of: (1) being only slightly higher or lower than normal; (2) also being present prior to EPG exposure; and/or (3) occurring sporadically, with no evidence of a relationship to EPG concentration.

Higher than normal serum transaminase (ALT and/or AST) levels were seen in some subjects at 60–150 g EPG. ALT and AST are markers of liver injury, but there are other non-hepatic causes of elevated ALT and AST, such as celiac disease, hypo- and hyperthyroidism, and strenuous exercise (reviewed by Dancygier and Rogart, 2010). These are unlikely to have been the cause of elevated ALT and AST in our study. However, Purkins et al. (2003) reported ALT and AST levels 1.5–2 times the normal values in a study of a study population similar to ours, 12 healthy men aged 20–41 years residing at a study facility, following consumption of a high-carbohydrate high-calorie diet for 8 days. Specifically, the rises in transaminase levels were

Table 4
Mean clinical chemistry values among subjects receiving increasing EPG concentrations in the diet.

Time period	EPG concentration	BUN (mmol/L)	Glu (mmol/L)	AST (IU/L)	ALT (IU/L)	AP (IU/L)	LDH (IU/L)	Na (mmol/L)	K (mmol/L)	Cl (mmol/L)	Ca (mmol/L)	Phos (mmol/L)	Bic (mmol/L)
Pre-study	None	4.6 ± 0.9	4.92 ± 0.49	18 ± 3	20 ± 7	162 ± 40	292 ± 73	139 ± 1	3.8 ± 0.3	105 ± 2	2.36 ± 0.09	0.94 ± 0.13	31 ± 5
Day 5	0 g[a]	4.1 ± 0.9	5.59 ± 0.31	26 ± 12	26 ± 11	156 ± 40	421 ± 140	141 ± 1	4.2 ± 0.3	106 ± 2	2.27 ± 0.09	1.04 ± 0.16	30 ± 2
Day 8	30 g	4.3 ± 0.9	4.50 ± 0.34	28 ± 19	35 ± 23	155 ± 39	284 ± 54	141 ± 1	3.9 ± 0.3	105 ± 2	2.31 ± 0.07	0.92 ± 0.15	27 ± 3
Day 11	60 g	4.4 ± 0.9	4.77 ± 0.33	31 ± 11	46 ± 28	162 ± 35	269 ± 41	139 ± 1	3.9 ± 0.3	105 ± 2	2.19 ± 0.05	0.93 ± 0.13	27 ± 2
Day 14	90 g	4.6 ± 0.7	4.69 ± 0.46	29 ± 13	48 ± 23	167 ± 39	281 ± 68	141 ± 1	4.0 ± 0.2	106 ± 2	2.28 ± 0.06	0.95 ± 0.13	28 ± 2
Day 17	120 g	4.9 ± 0.8	4.09 ± 0.57	27 ± 9	45 ± 19	173 ± 38	281 ± 33	140 ± 2	3.9 ± 0.3	104 ± 2	2.23 ± 0.07	0.92 ± 0.17	30 ± 2
Day 20	150 g	4.9 ± 0.9	4.35 ± 0.43	23 ± 9	43 ± 22	179 ± 40	285 ± 61	138 ± 1	3.9 ± 0.4	104 ± 1	2.27 ± 0.07	0.93 ± 0.14	31 ± 2
Day 22	None	4.4 ± 0.8	4.68 ± 0.43	28 ± 12	42 ± 18	178 ± 41	286 ± 49	141 ± 2	4.1 ± 0.3	105 ± 1	2.32 ± 0.08	0.88 ± 0.13	29 ± 2
	Normal range	1.7–8.3	4.22–6.11	<37	<40	98–279	230–460	135–150	3.3–4.8	99–109	2.02–2.60	0.87–1.45	23–29

Time period	EPG concentration	Creat (μmol/L)	T. Bil (μmol/L)	Uric (mmol/L)	TP (g/L)	Alb (g/L)	Glob (g/L)	A/G	Chol (mmol/L)	Trig (mmol/L)	HDL (mmol/L)	LDL (mmol/L)
Pre-study	None	94 ± 10	9.6 ± 3.8	325 ± 67	73 ± 2	46 ± 3	27 ± 2	1.8 ± 0.2	5.4 ± 0.9	1.64 ± 0.63	1.09 ± 0.18	3.58 ± 0.88
Day 5	0 g[a]	95 ± 8	6.2 ± 2.3	300 ± 59	68 ± 3	45 ± 2	23 ± 2	2.0 ± 0.1	4.8 ± 0.7	1.28 ± 0.39	0.88 ± 0.17	3.53 ± 0.78
Day 8	30 g	87 ± 5	6.9 ± 1.9	299 ± 59	67 ± 3	42 ± 2	25 ± 3	1.7 ± 0.2	4.6 ± 0.7	1.60 ± 0.48	0.95 ± 0.16	2.83 ± 0.69
Day 11	60 g	89 ± 7	6.1 ± 1.4	303 ± 64	69 ± 2	44 ± 2	24 ± 2	1.8 ± 0.2	4.9 ± 0.8	1.57 ± 0.41	0.83 ± 0.17	3.73 ± 0.86
Day 14	90 g	87 ± 6	6.7 ± 1.5	318 ± 59	69 ± 3	44 ± 2	26 ± 3	1.7 ± 0.2	5.1 ± 0.9	1.81 ± 0.58	0.90 ± 0.13	3.35 ± 0.67
Day 17	120 g	87 ± 8	7.5 ± 1.7	325 ± 61	69 ± 2	43 ± 2	26 ± 3	1.7 ± 0.2	5.1 ± 0.9	1.75 ± 0.51	0.74 ± 0.10	3.48 ± 0.74
Day 20	150 g	89 ± 6	8.5 ± 2.3	328 ± 61	69 ± 2	44 ± 2	25 ± 2	1.7 ± 0.2	5.1 ± 0.9	2.07 ± 0.61	0.75 ± 0.22	3.47 ± 0.69
Day 22	None	88 ± 7	9.3 ± 3.0	320 ± 60	71 ± 3	44 ± 2	27 ± 3	1.7 ± 0.2	5.2 ± 0.9	2.01 ± 0.54	0.72 ± 0.14	3.70 ± 0.66
	Normal range	82–106	<17.0	202–416	66–87	43–53	16–38	0.9–2.8	3.2–6.8	<2.28	0.9–1.43	<3.9

Values represent the mean ± SD for 16 subjects.
BUN: blood urea nitrogen; Glu: glucose; AST: aspartate aminotransferase; ALT: alanine aminotransferase; AP: alkaline phosphatase; LDH: lactate dehydrogenase; Na: sodium; K: potassium; Cl: chloride; Ca: calcium; Phos: inorganic phosphate; Bic: bicarbonate.
Creat: creatinine; T. Bil: total bilirubin; Uric: uric acid; TP: total protein; Alb: albumin; Glob: globulin; A/G: albumin/globulin ratio; Chol: total cholesterol; Trig: triglycerides; HDL: high-density lipoprotein; LDL: low-density lipoprotein.
[a] Test food items prepared with ordinary triglycerides (margarine) alone.

considered related to the carbohydrate content of the diet, especially sucrose, rather than its calorific value. Porikos and Van Itallie (1983) also reported transient elevations in ALT and AST levels in 21 male subjects receiving a hypercaloric high-sucrose diet for 18 days while housed in a metabolic ward. It is therefore possible that the elevated transaminase levels seen in this study were related to a higher intake of simple sugars from the test food items (cinnamon buns, biscuits, cookies), rather than to EPG intake.

Along with a number of conditions (*e.g.*, diabetes and end-stage renal disease) and agents (beta-blockers and thiazide diuretics), low-fat diets can result in reduced HDL cholesterol levels (Rader, 2007). This might account for the serum HDL decline of subjects in this study. Indeed, EPG gradually replaced (*i.e.*, reduced) up to half the available fat in the diet; at 150 g EPG, all subjects showed lower than normal HDL cholesterol values (data not shown).

Table 5
Mean urine specific gravity and pH values among subjects receiving increasing EPG concentrations in the diet.

Time period	EPG concentration	Specific gravity	pH
Pre-study	None	1.0209 ± 0.0081	5.71 ± 0.66
Day 5	0 g[a]	1.0228 ± 0.0066	5.91 ± 0.61
Day 8	30 g	1.0256 ± 0.0048	5.66 ± 0.63
Day 11	60 g	1.0238 ± 0.0056	5.78 ± 0.60
Day 14	90 g	1.0225 ± 0.0063	5.75 ± 0.55
Day 17	120 g	1.0238 ± 0.0062	5.47 ± 0.56
Day 20	150 g	1.0172 ± 0.0055	6.13 ± 0.34
Day 22	None	1.0206 ± 0.0073	5.50 ± 0.61

Values represent the mean ± SD for 16 subjects, except pre-study, which included 17 subjects.
[a] Test food items prepared with ordinary triglycerides (margarine) alone.

Because all abnormal values returned to normal after the study, and subjects were otherwise asymptomatic, the effects on transaminase and HDL levels observed in this study were considered possibly adaptive and not clinically significant. Other safety studies of EPG, including lifetime experimental animal studies, showed no effects on these transaminase or HDL levels.

There was no apparent association between EPG consumption and adverse effects reported. Most adverse events consisted of gastrointestinal symptoms and were reported on the days the test foods were consumed (*vs.* the 2 days that followed), suggesting it was related to the large volume of food consumed. Indeed, the most frequently reported adverse effect, reported on 20 occasions by nearly all (15/16) subjects, was bloating/fullness after consumption of test foods containing only ordinary triglycerides (0 g EPG). Flatulence was reported with greater frequency when subjects consumed EPG, but the incidence did not increase with increasing EPG concentration.

In general, EPG had no apparent effect on bowel function, except in a single subject, who reported increased frequency of movements during the 2 days that followed consumption of 150 g EPG. Bowel movements were most frequent on days the test foods were administered, probably related to the volume of food, rather than EPG, since the effect was also evident following consumption of foods without EPG (0 g). There was a shift toward “well-formed but soft” stool with EPG, but with no apparent relation to EPG concentration.

The results of this study indicate that intakes of up to 150 g EPG in a single day were safe and well tolerated by nearly all subjects. Based on this and the results of other studies, human dietary exposures of up to 20 g EPG/day from its currently intended commercial use as a fat substitute would not be expected to result in any adverse health effects.

Table 6
Adverse events reported by subjects receiving increasing EPG concentrations in the diet.

EPG concentration	Time period	Belching/ burping	Flatulence	Bloating/ fullness	Heartburn	Nausea	Vomiting	Abdominal pain	Other, non-GI	Difficulty swallowing	Anal pain	Oil in bowel motions	Abnormal bowel motion but presence of oil not recorded
0 g[a]	Day administered	2 (2)	4 (4)	20 (15)	2 (2)	15 (9)	3 (3)	2 (2)	0	7 (7)	0	0	0
	1 Day after	2 (2)	1 (1)	2 (2)	3 (3)	0	0	2 (2)	4 (4)	0	0	0	0
	2 Days after	1 (1)	2 (2)	2 (2)	0	0	0	2 (2)	0	0	0	0	1 (1)
30 g	Day administered	5 (5)	8 (8)	13 (12)	2 (2)	10 (9)	4 (2)	3 (3)	2 (2)	15 (7)	0	0	2 (2)
	1 Day after	1 (1)	1 (1)	1 (1)	1 (1)	0	0	3 (1)	5 (5)	0	0	0	1 (1)
	2 Days after	0	0	0	0	0	0	0	0	0	0	0	0
60 g	Day administered	2 (2)	7 (7)	9 (8)	0	6 (6)	0	4 (4)	1 (1)	15 (6)	0	1 (1)	1 (1)
	1 Day after	0	0	0	1 (1)	0	0	0	4 (3)	0	0	0	0
	2 Days after	0	0	0	0	0	0	0	3 (2)	0	0	0	0
90 g	Day administered	3 (3)	9 (9)	13 (9)	0	0	0	6 (4)	2 (2)	8 (2)	0	0	0
	1 Day after	0	1 (1)	0	0	0	0	4 (3)	4 (4)	0	0	0	0
	2 Days after	0	0	0	0	0	0	1 (1)	4 (4)	0	0	0	0
120 g	Day administered	2 (2)	6 (6)	4 (4)	0	0	0	2 (2)	4 (3)	4 (4)	0	0	1 (1)
	1 Day after	1 (1)	3 (3)	0	0	0	0	1 (1)	1 (1)	0	0	0	0
	2 Days after	0	1 (1)	1 (1)	0	0	0	0	0	0	0	0	2 (2)
150 g	Day administered	2 (2)	11 (11)	7 (7)	0	0	0	2 (2)	1 (1)	1 (1)	0	0	1 (1)
	1 Day after	0	2 (2)	1 (1)	0	0	0	3 (3)	1 (1)	0	1 (1)	0	1 (1)
	2 Days after	0	3 (3)	0	0	0	0	0	1 (1)	0	0	0	0

Each set of values represents the number of times the adverse event was reported with the number of subjects reporting the event in parentheses; 16 subjects completed the study.
[a] Test food items prepared with ordinary triglycerides (margarine) alone.

Table 7
Summary of bowel movement characterization.

EPG concentration	Time period	Total bowel movements	Description								Total movements rated as "unusual"[c]
			Formed but hard	Formed but soft	Poorly formed, loose	Loose, watery	Containing mucus	Pain-free	Painful	Accompanied by straining or cramping	
None	Pre-study	16	9	7	0	0	0	16	0	0	0
	Pre-study	22	10	12	0	0	0	22	0	0	0
	Pre-study	22	3	19	0	0	0	22	0	0	0
0 g[a]	Day administered	36	13	18	5	0	0	36	0	0	4
	1 Day after	20	6	12	2	0	0	20	0	0	3
	2 Days after	27	8	15	4	0	0	26	1	0	3
30 g	Day administered	44	2	29	9	4	0	42	0	2	7
	1 Day after	29	1	23	5	0	0	27	0	2	4
	2 Days after	24	2	19	3	0	0	24	0	0	2
60 g	Day administered	35	3	29	3	0	0	35	0	0	3
	1 Day after	25	2	21	2	0	0	25	0	0	0
	2 Days after	22	4	18	0	0	0	22	0	0	0
90 g	Day administered	33	2	30	1	0	0	33	0	0	0
	1 Day after	32	8	21	3	0	0	32	0	0	4
	2 Days after	16	2	14	0	0	0	16	0	0	0
120 g	Day administered	37	6	29	2	0	0	37	0	0	3
	1 Day after	26	1	22	3	0	0	26	0	0	1
	2 Days after	21	3	16	2	0	0	21	0	0	1
150 g	Day administered	43	4	37	2	0	0	42	1	0	1
	1 Day after	40	2	24	6	8	0	24	8	8	10[b]
	2 Days after	20	2	17	1	0	0	20	0	0	1

Values represent the totals reported by 16 subjects.
[a] Test food items prepared with ordinary triglycerides (margarine) alone.
[b] Subject# 1 had 10 "unusual" bowel movements after consuming 150 g EPG, 9 occurring 1 day after and 1 occurring 2 days after.
[c] Bowel movements might also have been classified as "unusual," with details such as "very pale in color" and/or "foul smelling." This classification would have been separate from the categories under *Description* in this table.

Conflicts of interest

The author is unaware of any conflicts of interest.

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Transparency document

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